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ALFRED J. MOSES

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Alfred J. Moses, Professor of Mineralogy in Columbia University, died on February 27, 1920, after a brief illness caused by cerebral hemorrhage. He passed away in his sixty-first year, in the full tide of his life's work, and by date of appointment was the Senior Professor in the Faculty of Applied Sciences.

Born in Brooklyn, New York, July 25, 1859, the son of Thomas Preston Moses and Margaret (Gaskell) Moses, he married first on June 23, 1887, Elizabeth Bacon Gilbert, and second on August 18, 1906, Margaret Carlton Magrath. He is survived by his widow, his sister Miss Louisa Moses, his married son, Alfred Staunton Moses and grandson, Alfred S. Moses, Jr., his daughter, Mrs. Margaret M. Fellows and his two younger sons, George M. and John H. Moses.

Professor Moses entered the School of Mines and graduated as an Engineer of Mines in the class of '82. His record as an undergraduate was brilliant, especially along mathematical lines. In 1890 he took his Ph.D. degree at Columbia University. Instead of pursuing his engineering career, he decided to accept an offer made by Professor Thomas Egleston, one of the founders of the School of Mines, to enter the Department of Mineralogy and Metallurgy as his assistant to succeed Dr. Colton. He became Adjunct Professor of Mineralogy in 1890, and, on the death of Professor Egleston in 1897, succeeded him as Professor of Mineralogy and in charge of the Mineralogical Museum. To prepare for this larger work, he spent a year abroad studying mineralogy with Professor Groth at Munich. After the move to the present site of the University, Professor Moses rearranged and enlarged the Mineralogical Museum on a new and more scientific basis. His special interest lay in the direction of

mathematical crystallography and one of his chief aims was to bring the crystallographic side of mineralogy into more practical use by the students. As the demand in the great city of New York became pressing for a more scientific knowledge of gems in the jewelry trade, Professor Moses built up a scientific and at the same time a very practical course in gems, and added a most interesting collection of gems and gem minerals to the museum. His principal textbook, "Mineralogy, Crystallography and Blowpipe Analysis," now in its fifth edition (written in collaboration with Professor C. L. Parsons) has been eminently successful, especially for the use of mining and metallurgical students. In addition, in 1899, he brought out a textbook on the "Characters of Crystals" and in 1912 wrote the mineralogical part of the book, "Practical Field Geology," by Farrell and Moses. He was also the author of the article on crystals in the *Encyclopedia Americana* and prepared the section on mineralogy for Peele's *Mining Engineers' Handbook*.

Professor Moses was quiet and retiring in his disposition and never mingled much in the public meetings connected with mineralogy, but by his colleagues his sound judgment, sterling character, and accurate knowledge were fully appreciated. He carried on his work for many years with marked success and was a most faithful and persistent student. Due largely to conditions requiring highly specialized training of large classes of students, Professor Moses developed his success more as a teacher than as an investigator. The appended bibliography of his works will show, however, a considerable number of successful and painstaking investigations. As notable among them may be mentioned the description of the new mercury minerals in the Terlingua district of Texas and the naming of eglestonite after the former Professor of Mineralogy at Columbia. For many years he was also Managing Editor of the *School of Mines Quarterly*.

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THE GOLDSCHMIDT TWO-CIRCLE METHOD. CALCULATIONS IN THE ISOMETRIC SYSTEM

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FORMS AND SYMBOLS¹

In the gnomonic projection the center of the projection is occupied by the pole of the top face of the cube; direction lines towards the front and side faces give the coördinates. In figure 24 the poles of faces of one each of the seven holohedral forms are shown, complete for one octant. The cube face (010) is the zero meridian ($\varphi = v_0 = 0$).

CUBE:

Index	Gdt.	φ	ρ
(001)	0	—	0 00
(010)	0 ∞	0 00	90 00
(100)	∞ 0	90 00	90 00

¹ The derivation of the Goldschmidt symbol from that of Miller has been explained in general terms on a previous page (*Gnom. Proj.*, p. 72). The index symbol is divided thru by its last term, making the last term unity, which is omitted. The two resulting numbers, whole or fractional, constitute the Goldschmidt symbol. Some confusion is apt to result in the case of index symbols having the last term 0 and a few examples may help to understand the usage.

(123)	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{3}{3}$	$\frac{1}{3}$	$\frac{2}{3}$	(1)	$\frac{1}{3}$	$\frac{2}{3}$
(112)	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	(1)	$\frac{1}{2}$	$\frac{1}{2}$
(100)	$\frac{1}{0}$	$\frac{1}{0}$	$\frac{0}{0}$	∞	0	(1)	∞	0
(110)	$\frac{1}{0}$	$\frac{1}{0}$	$\frac{0}{0}$	∞	∞	(1)	∞	∞
(120)	$\frac{1}{0}$	$\frac{2}{0}$	$\frac{0}{0}$	∞	2 ∞	(1)	∞	2
(230)	$\frac{2}{0}$	$\frac{3}{0}$	$\frac{0}{0}$	2 ∞	3 ∞	(1)	∞	$\frac{3}{2}$
(210)	$\frac{2}{0}$	$\frac{1}{0}$	$\frac{0}{0}$	2 ∞	∞	(1)	2	∞

The meaning of the two-place symbol, pq, is this: a distance p is measured in the X coördinate direction, and from the point so reached a distance q is measured parallel to the Y coördinate direction. The point so established is the face-pole of pq. In systems other than the isometric the distances measured are pp_0 and qq_0 and the starting point is the coördinate center, which may not coincide with the center of the projection.

For prism faces the symbol means that the face-pole is infinitely distant along a line thru the coördinate center and a face-pole whose coördinates are given in the symbol. In the cases given above the face-poles are respectively 10, 11, 12, $1\frac{1}{2}$, 21.

Where the two figures of the symbol are identical, one only is written.

OCTAHEDRON:

(111)	1	45 00	54 44
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DODECAHEDRON:

(011)	01	0 00	45 00
(101)	10	90 00	45 00
(110)	∞	45 00	90 00

Four faces of the dodecahedron lie at the ends of the coordinate diameters and therefore on the unit circle. Four others lie at infinity along the diagonals. The four octahedron faces lie along the diagonals at the intersection points of lines tangent to the unit circle at the dodecahedron poles.

These three forms are invariable in their position in the projection. The remaining forms vary with the particular values of their indices but the general position of their poles is always as described below. The position of poles in a single octant only is described, as shown in the figure.

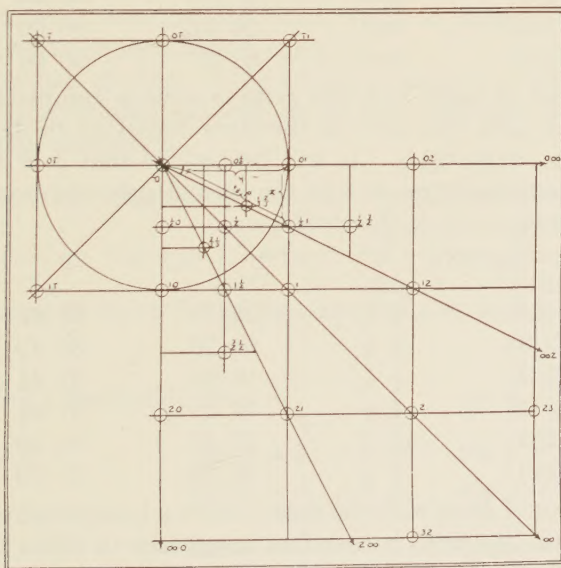


FIG. 24.

TRISOCTAHEDRON (triangle-faced trisoctahedron):

Index	Gdt.	φ	ρ
(122)	$\frac{1}{2}$ 1	26 34	48 11
(212)	1 $\frac{1}{2}$	63 26	48 11
(221)	2	45 00	70 31

The first two faces have φ complementary and the same ρ and one of them only (the first) is given in the angle-table. ρ of the third face is always greater than ρ of the first two.

TRAPEZOHEDRON (quadrilateral-faced trisoctahedron):

Index	Gdt.	φ	ρ
(112)	$\frac{1}{2}$	45 00	35 16
(121)	12	26 34	65 54
(211)	21	63 26	65 54

The last two faces have φ complementary and the same ρ and one of them only (the second) is given in the angle-table. ρ of the first face is always less than ρ of the last two.

TETRAHEXAHEDRON:

Index	Gdt.	φ	ρ
(012)	$0\frac{1}{2}$	0 00	26 34
(102)	$\frac{1}{2}$ 0	90 00	26 34
(021)	0 2	0 00	63 26
(201)	2 0	90 00	63 26
(120)	∞ 2	26 34	90 00
(210)	2 ∞	63 26	90 00

Each pair of faces with the same ρ have φ complementary; one of each pair (the first) is therefore necessary to define the form in the angle-table. It will be noticed that ρ of the first pair is complementary to ρ of the second pair and equal to φ (or its complement) of the third pair.

HEXOCTAHEDRON:

Index	Gdt.	φ	ρ
(123)	$\frac{1}{3}$ $\frac{2}{3}$	26 34	36 42
(213)	$\frac{2}{3}$ $\frac{1}{3}$	63 26	36 42
(132)	$\frac{1}{2}$ $\frac{3}{2}$	18 26	57 41
(312)	$\frac{3}{2}$ $\frac{1}{2}$	71 34	57 41
(231)	2 3	33 41	74 30
(321)	3 2	56 19	74 30

Each pair of faces with the same ρ have φ complementary; one of each pair (the first) is therefore necessary to define the form in the angle-table.

The positions of faces of these several forms have been considered in the first octant. All forms will have corresponding faces in the other octants with the same values of ρ and with φ values as follows: In the second octant (counting clockwise) $\varphi^2 = 180^\circ - \varphi^1$; in the third octant $\varphi^3 = - (180^\circ - \varphi^1)$; in the fourth octant $\varphi^4 = - \varphi^1$.

In the angle-tables the forms are tabulated alike for all the various symmetry groups of the system. The symmetry is stated at the head of the table and it is left to the reader to decide which faces of a given form should be present for a given symmetry.

CALCULATION OF SYMBOL FROM MEASURED ANGLES, φ AND ρ

In Gnom. Proj., page 69, are given the following equations:

$$x = \sin \varphi \tan \rho = pp_0$$

$$y = \cos \varphi \tan \rho = qp_0$$

Since in the isometric system $p_0 = 1$, $x = p$ and $y = q$.

The values of x and y calculated from the measured angles will therefore give directly the symbol pq . The numbers obtained from $\log x$ and $\log y$ will be approximately either whole numbers or decimal equivalents of simple fractions. On page 24 of Goldschmidt's *Winkeltabellen* is given a table of decimal equivalents of the commoner fractions, which is often of use when the fraction to be identified is complex.

The symbols of most of the common isometric forms can be determined graphically as soon as the measurements are plotted in gnomonic projection.

CALCULATION OF ANGLES FROM SYMBOL

$$pq \quad (p < q) \quad \tan \varphi = \frac{p}{q} \quad \tan \rho = \sqrt{p^2 + q^2} = \frac{p}{\sin \varphi} = \frac{q}{\cos \varphi}$$

(See figure 24 where the values φ and $\tan \rho$ are indicated for the form $\frac{1}{2} 1$).

$\frac{p}{n} \frac{q}{n}$ (p and q fractional)	$\tan \varphi = \frac{p}{q}$	$\tan \rho = \frac{1}{n} \sqrt{p^2 + q^2}$
p ($p = q$)	$\tan \varphi = 1; \varphi = 45^\circ$	$\tan \rho = p \sqrt{2}$
$0q$	$\tan \varphi = 0; \varphi = 0$	$\tan \rho = q$
∞q	$\tan \varphi = \frac{1}{q}$	$\tan \rho = \infty; \rho = 90^\circ$

In the *Winkeltabellen*, page 25, there is a table containing values of φ for all commonly occurring values of p and q . It can be used either to find φ for a given symbol (ratio of $p : q$) or to find the symbol for a measured φ angle.

On pages 22 and 23 are tables giving $\log \tan \rho$ for all values of p and q from 1 to 10 and for fractional values ($n = 1$ to 10).

To illustrate the use of these tables, find the three values of φ and ρ for the form (123). (See above, hexoctahedron, page 114).

$\frac{p}{n} \frac{q}{n}$	$p : q$	φ (p. 25)	$\log \frac{1}{n} \sqrt{p_2 + q_2}$ (p. 22)	$\log \tan \rho$	ρ
$\frac{1}{3} \frac{2}{3}$	1 : 2	26° 34'	$\log \frac{1}{3} \sqrt{5}$	9.87236	36° 42'
$\frac{1}{2} \frac{3}{2}$	1 : 3	18 26	$\log \frac{1}{2} \sqrt{10}$	0.19897	57 41
2 3	2 : 3	33 41	$\log \sqrt{13}$	0.55697	74 30

ILLUSTRATION OF THE ISOMETRIC SYSTEM.— PYRITE FROM FALLS OF FRENCH CREEK, PA.

EDGAR T. WHERRY

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Pyrite is an abundant mineral at the Falls of French Creek iron mine, and the remarkable elongated octahedral crystals formerly found there have been studied in detail by Penfield.¹ These occurred embedded in calcite; and the majority of the crystals found in that association are simple octahedral in habit, with but rarely small faces of other forms. The crystals which occur implanted on the crusts of magnetite are, however, of an entirely different habit. In them the cube is dominant, but there are also prominent faces of a rather flat diploid, and smaller ones of many other modifying forms. The cube faces are usually curved, often decidedly wavy, and more or less dulled by etching. Reaching a maximum diameter of a centimeter or more, and occurring in groupings often thickly scattered over the brilliant black magnetite, these pyrites yield striking mineral specimens, and they seem worthy of description, even though they show no new nor even unusual forms for the mineral.

Two of these crystals² were mounted and studied on the Goldschmidt two-circle goniometer as described in preceding papers in this series. They were oriented by means of the smoothest cube faces which could be found on each. The most brilliant faces present prove to be the quadrilateral-faced trisoctahedron or trapezohedron, (211); the dominant diploid, which proves to be (421), comes next in order of brilliance, closely followed by the cube (100). The faces of the remaining forms are relatively dull, curved, or otherwise imperfect.

¹ *Am. J. Sci.* [3], 37, 209, 1889.

² Kindly loaned by Mr. S. G. Gordon.

TABLE 1

ANGLES OF FORMS PRESENT ON PYRITE FROM FALLS OF FRENCH CREEK

Forms		Symbols		Description	Observed		Calculated	
No.	Let-ter	Gdt.	Mill.		ϕ	ρ	ϕ	ρ
1	c	0	001	Brilliant, but some- what wavy	— —	0°00'	— —	0°00'
		0 ∞	010		0°00'	90 00	0°00'	90 00
		∞ 0	100		90 00	90 00	90 00	90 00
2	e	0 $\frac{1}{2}$	012	Striated, irregular	0 00	26 30	0 00	26 34
		02	021		0 00	63 30	0 00	63 26
		∞ 2	120		26 30	90 00	26 34	90 00
		21	211		63 29	65 58	63 26	65 54
3	n	$\frac{1}{2}$	112	Brilliant, well de- veloped	45 00	35 20	45 00	35 16
		12	121		26 32	65 58	26 34	65 54
		$\frac{1}{2}$ $\frac{1}{2}$	148		14 00	27 00	14 02	27 16
4	w	$\frac{1}{2}$ 2	184	Minute, curved	7 00	63 00	7 07	63 36
		48	481		26 00	83 00	26 34	83 37
		$\frac{1}{2}$ $\frac{1}{2}$	124		26 30	29 10	26 34	29 12
5	t	$\frac{1}{2}$ 2	142	Brilliant, but some- what wavy	14 08	64 02	14 02	64 07
		24	241		26 40	77 14	26 34	77 23
		$\frac{1}{2}$ $\frac{1}{2}$	134		18 00	40 00	18 26	38 19
6	H ₁	$\frac{1}{2}$ $\frac{1}{2}$	143	Minute, curved; present on one crystal only	15 00	54 00	14 02	53 57
		34	341		36 00	80 00	36 52	78 41

LISTS OF THE ISOMETRIC MINERALS INCLUDED IN GOLD-SCHMIDT'S WINKELTABELLEN. EDGAR T. WHERRY. *Washington, D.C.*—In the Winkeltabellen the minerals are arranged alphabetically, the crystal system and class being given below each. This makes it easy to locate any desired mineral—a table of synonyms aiding the finding of those included under one name, but sought under another. It is often interesting, however, in connection with various crystallographic studies, to have brought together minerals showing similarity in crystallization. The following grouping of the hundred isometric minerals included in the tables therefore seems worth publishing. The arrangement on the basis of classes and habits needs no explanation. The lists do not pretend to be complete in the sense of covering every mineral known or supposed to crystallize in this system, but they do include practically all which occur in really well developed crystals.

CLASS HOLOHEDRAL

DOMINANT HABIT CUBIC

		Page		Page
Copper (Kupfer)	Cu	204	Beegerite	Pb ₃ Bi ₂ S ₃ 64
Iron (Eisen)	Fe	122	Halite (Steinsalz)	NaCl 327
Platiniferous Iridium	Ir, Pt	193	Cerargyrite (Chlorsilber)	AgCl 96
Ferriferous Platinum	Pt, Fe	268	Embolite	Ag(Cl, Br) 126
Oldhamite	CaS	251	Bromyrite (Bromsilber)	AgBr 79
Argentite (Silberglanz)	Ag ₂ S	317	Hydrophilite (Chlorocalcit),	
Naumannite (Selsilber)	Ag ₂ Se	314		CaCl ₂ 95
Hessite	Ag ₂ Te	176	Fluorite (Fluszsapat)	CaF ₂ 148
Galenite (Bleiglanz)	PbS	71	Percylite (Percylith),	
Clausthalite (Selenblei)	PbSe	314		PbCuCl ₂ (OH) ₂ 260
Altaite	PbTe	35	Periclasite (Periklas)	MgO 260
Bornite (Buntkupfererz),			Dysanalyte	Ca-Fe-Ti-Ch-O 121
Cu ₅ FeS ₄		82	Pollucite	H ₂ Cs ₂ Al ₂ (SiO ₃) ₅ 269

DOMINANT HABIT OCTAHEDRAL

Silver (Silber).....	Ag	316
Gold.....	Au	163
Lead (Blei).....	Pb	70
Platiniferous palladium . Pd,Pt		257
Pentlandite.....	(Ni,Fe)S	260
Polydymite.....	Ni ₃ S ₄	270
Linneite.....	Co ₃ S ₄	222
Brongniardite.....	PbAg ₂ Sb ₂ S ₅	79
Iodobromite (Jodobromit),		
	Ag ₅ Cl ₂ Br ₂ I	189
Hieratite.....	K ₂ SiF ₆	177
Ralstonite. (Na ₂ Mg)Al ₂ F ₆ ·2H ₂ O		291
Arsenolite (Arsenit).....	As ₂ O ₃	54
Senarmontite.....	Sb ₂ O ₃	316
Manganosite.....	MnO	231
Bunsenite.....	NiO	82
Spinel.....	MgAl ₂ O ₄	324
Chromite (Chromeisenerz),		
	FeCr ₂ O ₄	96
Jacobsite.....	MnFe ₂ O ₄	186
Franklinite.....	Zn(Fe,Mn) ₂ O ₄	151
Magnetite (Magnetiseinerz),		
	Fe ₃ O ₄	225
Uraninite (Uranpecherz),		
	UO ₂ +X	356
Atopite.....	Ca ₂ Sb ₂ O ₇	57
Schneebergite.....	Ca-Sb-O	312
Monimolite.....	Pb ₃ Sb ₂ O ₈	244
Pyrochlorite (Pyrochlor),		
	CaCb ₂ O ₆ +X	279
Hatchettolite .. (Ca,UO ₂)Cb ₂ O ₆		171
Microlite.....	Ca ₂ Ta ₂ O ₇ +X	241
Voltaite.....	K-Fe-S-O	360
Faujasite.....	H-Na-Ca-Al-Si-O	139

DOMINANT HABIT DODECAHEDRAL

Mercuriferous Silver (Amalgam).....	Ag,Hg	36
Koppite.....	Ca ₂ Cb ₂ O ₇ +X	200
Sulfohalite.....	Na ₈ Cl ₂ (SO ₄) ₃	332
Garnet (Granat),		
	(Ca,Mg,Fe) ₃ (Al,Fe) ₂ (SiO ₄) ₃	164

DOMINANT HABIT TRAPEZOHEDRAL

Berzeliite.....	(Ca,Mn)(AsO ₄) ₂	68
Analcite (Analcim),		
	NaAl(SiO ₃) ₂ ·H ₂ O	38

CLASS PYRITOHEDRAL

DOMINANT HABIT CUBIC

Pyrite.....	FeS ₂	275
Sperrylite.....	PtAs ₂	324

DOMINANT HABIT OCTAHEDRAL

Hauerite.....	MnS ₂	172
Cloanthite-smaltite. (Ni,Co)As ₂		94
Laurite.....	RuS ₂	214
Skutterudite.....	CoAs ₃	322
Alum (Alaun).KAl(SO ₄) ₂ ·12H ₂ O		33

CLASS TETRAHEDRAL

DOMINANT HABIT TETRAHEDRAL
(OR OCTAHEDRAL)

Diamond.....	C	114
Metacinnabarite.....	HgS	239
Tiemannite.....	HgSe	343
Tetrahedrite (Fahlerz),		
	Cu ₄ SbS ₄ +X	137
Nantokite.....	CuCl	246
Helvite (Helvin),		
	(Be,Mn) ₇ S(SiO ₄) ₃	174
Danalite.....	(Be,Zn) ₇ S(SiO ₄) ₃	107
Zunyite.....	Al(F,Cl)-OH-(SiO ₄)	380
Eulytite (Eulytin)...	Bi ₄ (SiO ₄) ₃	136

DOMINANT HABIT DODECAHEDRAL

Sphalerite (Zinkblende)...	ZnS	372
Alabandite (Manganblende),		
	MnS	229
Argyrodite.....	Ag ₈ GeS ₅	54
Sodalite.....	Na ₄ Al ₃ Cl(SiO ₄) ₃	323
Hauynite (Hauyn),		
	Na ₂ CaAl ₃ (SO ₄)(SiO ₄) ₃	173
Noselite (Nosean),		
	Na ₅ Al ₃ (SO ₄)(SiO ₄) ₃	250

CLASS TETARTOHEDRAL

DOMINANT HABIT CUBIC

Cobaltite (Glanzkobalt).CoSAs		157
Gersdorffite.....	NiSAs	157
Ullmannite.....	NiSSb	354

DOMINANT HABIT TETRAHEDRAL

Corynite.....	NiS(As,Sb)	104
Nitrobarite (Barytsalpeter),		
	Ba(NO ₃) ₂	63

CLASS GYROIDAL

(PLAGIHEDRAL)

DOMINANT HABIT CUBIC

Sylvite (Sylvin).....	KCl	335
Sal-Ammoniac (Salmiak),		
	NH ₄ Cl	308
Cuprite (Rothkupfererz).Cu ₂ O		305

SYN-ISOMETRIC (that is, really possessing lower symmetry, but twinned so as to imitate isometric form)

DOMINANT HABIT CUBIC

Boleite.....	Pb(Cu,Ag)Cl ₂ (OH) ₂	74
Melanophlogite.....	SiO ₂ +X	236
Perovskite (Perowskit).CaTiO ₃		261
Boracite.....	Mg ₂ Cl ₂ B ₁₆ O ₃₀	74
Pharmacosiderite,		
	Fe ₄ (OH) ₃ (AsO ₄) ₃	263

DOMINANT HABIT OCTAHEDRAL
Cristobalite SiO_2 96
Kremersite ... $\text{KNH}_4\text{FeCl}_5 \cdot \text{H}_2\text{O}$ 201

DOMINANT HABIT DODECAHEDRAL
Rhodizite $(\text{K}, \text{Cs})\text{Al}_2\text{B}_3\text{O}_8$ 294

DOMINANT HABIT TRAPEZOHEDRAL
Leucite $\text{KAl}(\text{SiO}_3)_2$ 218

ERRONEOUSLY CLASSED AS ISOMETRIC

(or as independent species)

Cubanite and carrollite, mixtures;
Binnite, a variety of tetrahedrite;
Polyargyrite, probably impure argen-
tite; Stannite (Zinnkies), really tet-
ragonal.

CHORD AND TANGENT TABLES FOR USE WITH THE GOLDSCHMIDT METHOD

Natural Tangents X 5 cm. for plotting <u>the</u> angles.													
ϕ°	0	10	20	30	40	50	ϕ°	0	10	20	30	40	50
0	0.000	0.014	0.029	0.044	0.058	0.073	45	5.000	5.029	5.058	5.088	5.118	5.148
1	0.007	0.010	0.016	0.021	0.026	0.031	46	5.178	5.208	5.238	5.269	5.300	5.331
2	0.014	0.019	0.024	0.029	0.034	0.039	47	5.362	5.393	5.425	5.456	5.488	5.521
3	0.021	0.027	0.031	0.036	0.041	0.046	48	5.553	5.586	5.618	5.651	5.685	5.718
4	0.028	0.034	0.039	0.043	0.048	0.053	49	5.752	5.786	5.820	5.854	5.889	5.924
5	0.037	0.042	0.047	0.051	0.056	0.061	50	5.959	5.994	6.030	6.065	6.101	6.138
6	0.045	0.050	0.055	0.059	0.064	0.069	51	6.174	6.211	6.248	6.285	6.323	6.361
7	0.054	0.059	0.064	0.069	0.073	0.078	52	6.400	6.438	6.477	6.516	6.555	6.595
8	0.063	0.067	0.072	0.077	0.081	0.086	53	6.635	6.675	6.716	6.757	6.798	6.840
9	0.072	0.077	0.082	0.087	0.092	0.097	54	6.882	6.924	6.967	7.010	7.053	7.097
10	0.082	0.087	0.092	0.097	0.102	0.107	55	7.141	7.185	7.230	7.275	7.320	7.366
11	0.092	0.097	0.102	0.107	0.112	0.117	56	7.413	7.459	7.507	7.554	7.602	7.650
12	0.103	0.108	0.113	0.118	0.123	0.128	57	7.699	7.749	7.798	7.848	7.899	7.950
13	0.114	0.119	0.124	0.129	0.134	0.139	58	8.002	8.054	8.106	8.159	8.213	8.267
14	0.127	0.132	0.137	0.142	0.147	0.152	59	8.321	8.376	8.432	8.488	8.545	8.602
15	0.140	0.145	0.150	0.155	0.160	0.165	60	8.660	8.719	8.778	8.837	8.898	8.959
16	0.154	0.159	0.164	0.169	0.174	0.179	61	9.020	9.082	9.145	9.209	9.273	9.338
17	0.168	0.173	0.178	0.183	0.188	0.193	62	9.404	9.470	9.537	9.605	9.673	9.743
18	0.182	0.187	0.192	0.197	0.202	0.207	63	9.813	9.884	9.956	10.028	10.102	10.176
19	0.197	0.202	0.207	0.212	0.217	0.222	64	10.251	10.328	10.405	10.483	10.562	10.642
20	0.212	0.217	0.222	0.227	0.232	0.237	65	10.723	10.804	10.887	10.971	11.057	11.143
21	0.227	0.232	0.237	0.242	0.247	0.252	66	11.230	11.319	11.408	11.499	11.591	11.685
22	0.242	0.247	0.252	0.257	0.262	0.267	67	11.779	11.875	11.972	12.071	12.171	12.273
23	0.257	0.262	0.267	0.272	0.277	0.282	68	12.375	12.480	12.586	12.693	12.802	12.913
24	0.272	0.277	0.282	0.287	0.292	0.297	69	13.025	13.140	13.255	13.373	13.493	13.614
25	0.287	0.292	0.297	0.302	0.307	0.312	70	13.737	13.863	13.990	14.120	14.251	14.385
26	0.302	0.307	0.312	0.317	0.322	0.327	71	14.521	14.659	14.800	14.943	15.089	15.237
27	0.317	0.322	0.327	0.332	0.337	0.342	72	15.388	15.542	15.660	15.838	16.020	16.186
28	0.332	0.337	0.342	0.347	0.352	0.357	73	16.354	16.526	16.701	16.880	17.062	17.248
29	0.347	0.352	0.357	0.362	0.367	0.372	74	17.437	17.630	17.828	18.029	18.235	18.445
30	0.362	0.367	0.372	0.377	0.382	0.387	75	18.600	18.800	19.004	19.334	19.568	19.808
31	0.377	0.382	0.387	0.392	0.397	0.402	76	20.054	20.305	20.563	20.826	21.097	21.374
32	0.392	0.397	0.402	0.407	0.412	0.417	77	21.657	21.948	22.247	22.554	22.868	23.191
33	0.407	0.412	0.417	0.422	0.427	0.432	78	23.523	23.868	24.215	24.574	24.947	25.329
34	0.422	0.427	0.432	0.437	0.442	0.447	79	25.723	26.128	26.540	26.978	27.423	27.882
35	0.437	0.442	0.447	0.452	0.457	0.462	80	28.356	28.847	29.354	29.879	30.422	30.985
36	0.452	0.457	0.462	0.467	0.472	0.477	81	31.569	32.174	32.803	33.456	34.135	34.841
37	0.467	0.472	0.477	0.482	0.487	0.492	82	35.577	36.344	37.144	37.979	38.852	39.765
38	0.482	0.487	0.492	0.497	0.502	0.507	83	40.722	41.725	42.778	43.884	45.049	46.277
39	0.497	0.502	0.507	0.512	0.517	0.522	84	47.572	48.941	50.390	51.927	53.500	55.207
40	0.512	0.517	0.522	0.527	0.532	0.537	85	57.150	59.131	61.252	63.531	65.984	68.633
41	0.527	0.532	0.537	0.542	0.547	0.552	86	71.503	74.622	78.024	81.750	85.847	90.375
42	0.542	0.547	0.552	0.557	0.562	0.567	87	95.406	101.03	107.35	114.52	122.71	132.16
43	0.557	0.562	0.567	0.572	0.577	0.582	88	143.18	156.21	171.84	190.94	214.82	245.52
44	0.582	0.587	0.592	0.597	0.602	0.607	89	286.45	343.75	429.70	572.95	859.42	1718.9
ϕ°	0	10	20	30	40	50	ϕ°	0	10	20	30	40	50

Natural Chords ($2 \times \sin \frac{\phi}{2}$) for plotting <u>phi</u> angles.						
ϕ°	0	10	20	30	40	50
0	0.0000	0.0029	0.0058	0.0087	0.0116	0.0145
1	0.0175	0.0204	0.0233	0.0262	0.0291	0.0320
2	0.0349	0.0378	0.0407	0.0436	0.0465	0.0494
3	0.0524	0.0553	0.0582	0.0611	0.0640	0.0669
4	0.0698	0.0727	0.0756	0.0785	0.0814	0.0843
5	0.0872	0.0901	0.0931	0.0960	0.0989	0.1018
6	0.1047	0.1076	0.1105	0.1134	0.1163	0.1192
7	0.1221	0.1250	0.1279	0.1308	0.1337	0.1366
8	0.1395	0.1424	0.1453	0.1482	0.1511	0.1540
9	0.1569	0.1598	0.1627	0.1656	0.1685	0.1714
10	0.1743	0.1772	0.1801	0.1830	0.1859	0.1888
11	0.1917	0.1946	0.1975	0.2004	0.2033	0.2062
12	0.2091	0.2119	0.2148	0.2177	0.2206	0.2235
13	0.2264	0.2293	0.2322	0.2351	0.2380	0.2409
14	0.2437	0.2466	0.2495	0.2524	0.2553	0.2582
15	0.2611	0.2639	0.2668	0.2697	0.2726	0.2755
16	0.2783	0.2812	0.2841	0.2870	0.2899	0.2927
17	0.2956	0.2985	0.3014	0.3042	0.3071	0.3100
18	0.3129	0.3157	0.3186	0.3215	0.3244	0.3272
19	0.3301	0.3330	0.3358	0.3387	0.3416	0.3444

20	0.3473	0.3502	0.3530	0.3559	0.3587	0.3616
21	0.3645	0.3673	0.3702	0.3730	0.3759	0.3788
22	0.3816	0.3845	0.3873	0.3902	0.3930	0.3959
23	0.3987	0.4016	0.4044	0.4073	0.4101	0.4130
24	0.4158	0.4187	0.4215	0.4244	0.4272	0.4300
25	0.4329	0.4357	0.4386	0.4414	0.4442	0.4471
26	0.4499	0.4527	0.4556	0.4584	0.4612	0.4641
27	0.4669	0.4697	0.4725	0.4754	0.4782	0.4810
28	0.4838	0.4867	0.4895	0.4923	0.4951	0.4979
29	0.5008	0.5036	0.5064	0.5092	0.5120	0.5148
30	0.5176	0.5204	0.5233	0.5261	0.5289	0.5317
31	0.5345	0.5373	0.5401	0.5429	0.5457	0.5485
32	0.5513	0.5541	0.5569	0.5597	0.5625	0.5653
33	0.5680	0.5708	0.5736	0.5764	0.5792	0.5820
34	0.5847	0.5875	0.5903	0.5931	0.5959	0.5987
35	0.6014	0.6042	0.6070	0.6097	0.6125	0.6153
36	0.6180	0.6208	0.6236	0.6263	0.6291	0.6319
37	0.6346	0.6374	0.6401	0.6429	0.6456	0.6484
38	0.6511	0.6539	0.6566	0.6594	0.6621	0.6649
39	0.6676	0.6704	0.6731	0.6758	0.6786	0.6813
40	0.6840	0.6868	0.6895	0.6922	0.6950	0.6977
41	0.7004	0.7031	0.7058	0.7085	0.7113	0.7140
42	0.7167	0.7195	0.7222	0.7249	0.7276	0.7303
43	0.7330	0.7357	0.7384	0.7411	0.7438	0.7465
44	0.7492	0.7519	0.7546	0.7573	0.7600	0.7627
45	0.7654	0.7681	0.7707	0.7734	0.7761	0.7788

NOTES AND NEWS

Mr. Edwin T. Hodge of the University of British Columbia has been appointed to a full professorship of mineralogy and ore deposits at the University of Oregon. After September 1st he should be addressed at Eugene, Oregon.

Dr. William E. Ford has been promoted to a professorship of mineralogy in the Sheffield Scientific School, Yale University.

The American Association for the Advancement of Science has made a grant of \$100 to Professor John C. Shedd of Occidental College, Los Angeles, to aid in his studies of snow crystals from the standpoint of the physicist.

The report of the occurrence of rhodonite at the Strickland Quarry, Portland, Connecticut, made in the October, 1919, number of this magazine (page 124), proves to be erroneous. Professor Foye informs us that further examination has shown the absence of silica and the presence of phosphoric oxide; the mineral proves, in fact, to be *lithiophilite*. He wishes to add two other minerals to the list of those found at the quarry, namely calcite in "nail-head" crystals in tourmaline vugs; and *asbestiform* tourmaline, the latter determined by Professor William North Rice.

The initial number of a new abstract journal, "Revue de géologie et des sciences connexes"—"Review of geology and connected sciences"—"Rassegna di geologia e delle scienze affini," has just been received. It includes a department devoted to crystallography and mineralogy. In it all articles published since the beginning of the great war in other countries than Germany and Austria are to be abstracted, either in French, English or Italian. The subscription price is not announced in this number. Information concerning this publication can be obtained from: M. Jean Anten, Secrétaire, Laboratoire de géologie, Université de Liège, Belgium.

THE POORHOUSE QUARRY, CHESTER COUNTY, PA.

HUGH E. MCKINSTRY

Cambridge, Mass.

About the middle of the last century, Dana gave the name chesterlite to a newly-reported mineral from the limestone quarry of the Chester County Home, near Embreeville, Chester County, Pa. The quarry, which is still worked intermittently, has furnished fine specimens of this and other minerals, a large number of which came into the collection of the late Charles H. Pennypacker of West Chester.

The locality is of historic interest because of the prolonged discussion that waged thru the literature of the time, as to the identity of chesterlite. It had the composition and appearance of orthoclase, but was an enigma because it gave indication of being triclinic in crystallization. In 1853, Smith and Brush¹ wrote: "If it shall be proved that the form is triclinic it will be a potash albite and as such an interesting species." Finally Descloizeaux,² in 1876, used chesterlite as one of his types in establishing microcline as the triclinic potash feldspar.

The crystals of chesterlite show the adularia habit, that is, the side pinacoid (010) is lacking and the two prism faces meet at an acute angle. This produces a form which at first glance suggests a rhombohedron rather than the familiar symmetry of a feldspar.

The quarry is located along the West Chester-Embreeville road, one kilometer east of the Chester County Home (coördinate location, according to the Kemp system, West Chester Quadrangle 1821). It may be reached from either Embreeville or Glen Hall Station on the Philadelphia and Reading Railway or from Sugar's Bridge on the West Chester-Coatesville trolley line.

The rock is a white, highly crystalline magnesian limestone of a formation which occupies a narrow valley about 6 km. (4 miles) long between a ridge of Wissahickon mica gneiss on the south and a biotite gneiss, with local development of hornblende, on the north.

In the limestone are numerous gash-like crevices which are lined with crystals of chesterlite, calcite, dolomite and clear to milky quartz.

¹ *Am. J. Sci.* [2], 16, 42, 1853.

² *Ann. Chem. Phys.* [5], 9, 433-499, 1876.

The crystals are frequently coated with a thin film of limonite, which gives a bronze-like to iridescent luster to their surfaces. In this respect, as well as in general appearance of specimens, there is a remarkable resemblance to the limestone minerals from Lime Rock, R. I.

The locality is a fascinating one for collecting, as much depends on the mineralogist's skill with a chisel—fine chesterlites being prone to display their perfect cleavage at inconvenient moments.

Following is an alphabetical list of minerals reported from the locality, with references:

Amphibole, var. mountain leather	Rand, 1867
var. tremolite	Benge and Wherry, 1908
Calcite	Dana, 1850
Colorless scalenohedra	
Chlorite	Benge and Wherry, 1908
Dolomite. Crystals [Simple unit rhombohedron]	Dana, 1850
Muscovite. (margarodite? damourite? talc?)	Dana, 1850
Yellow, minute tuft-like aggregates	Smith and Brush, 1853
Microcline, var. chesterlite	Dana, 1850
White to flesh-colored crystals on dolomite. "Rosettes" up to 5 cm. in diameter	
Phlogopite	Rogers, 1858
Flakes in limestone	
Pyrite	Carpenter, 1828
Truncated cubes and cubo-octahedra	
Quartz	Carpenter, 1828
Crystals 10×4 cm. in diameter	
Rutile	Carpenter, 1828
Brilliant, dark ruby red, occasionally transparent, striated and terminated prisms, 2.5 cm.×3 mm.	
Zoisite, on quartz	Dana, 1850

PROCEEDINGS OF SOCIETIES

PHILADELPHIA MINERALOGICAL SOCIETY

Wagner Free Institute of Science, April 8, 1920

A stated meeting of the Philadelphia Mineralogical Society was held on the above date with the vice-president, Mr. Trudell, in the chair. Fifteen members and three visitors were present.

Mr. J. Harlan Johnson addressed the society on "Some Black Hills Minerals and Mineral Localities." The most important source of the minerals of the district are the pegmatites, which are remarkable for their coarse texture, and the perfect regularity of the enormous crystals of spodumene, beryl, tourmaline, and columbite found in them. Scott's rose quartz mine lies 4 miles south of Custer, the rose quartz forming a vein about 30 feet in width. A vote of thanks was tendered to the speaker for his interesting communication and exhibition of Black Hills minerals.

Mr. Charles W. Hoadley described a number of recent trips to Robeson, Birdsboro, Jones mine, Falls of French Creek, and Frankford. He reported

the finding of muscovite crystals in veins in diabase from Fort Lee, and small hematite crystals in sandstone beneath the Palisade sill; these minerals having been noticed in building stones from Fort Lee and Alpine.

Mr. Gordon exhibited a series of corundum, diaspore, tourmaline, margarite, euphyllite, and damourite from the corundum pegmatites of Unionville. Three types of sodic pegmatite, allied to plumasite, occur in Pennsylvania, all either intrusive in meta-peridotite, or occurring at the contact of such masses and Wissahickon gneiss: the albite with hornblende type (Sylmar); the albite-corundum type (Black Horse and Morgan Station); and the albite-corundum-tourmaline-margarite type (Unionville). A characteristic feature of the corundum-bearing types is the occurrence of a sheathing of albite, margarite, or damourite about the larger corundum crystals, representing a late stage of the crystallization of the pegmatite, with the hydrothermal alteration of the earlier formed corundum crystals to these minerals. A trip was reported to Glen Riddle and Lenni, where actinolite was found at the contact of pegmatite and meta-peridotite.

Mr. Ford reported a trip to Phoenixville, where the Chester County lead mine (one of the Wheatley group) is in active operation. As the ore is hand-picked in the mine and fed to a crusher, no specimens are obtainable on the surface.

SAMUEL G. GORDON, *Secretary*.

NEW YORK MINERALOGICAL CLUB

The annual meeting of the New York Mineralogical Club was held in the Morgan Hall of Minerals, at the American Museum of Natural History, on the evening of April 21, at 8.00 P.M. The president, Dr. George F. Kunz, presided and there was an attendance of 28 members and guests. Officers for the ensuing year were nominated and elected, as follows:

For President.....	Dr. George F. Kunz,
“ Vice-President.....	Mr. George E. Ashby,
“ Corresponding Secretary.....	Dr. Wallace Goold Levison,
“ Recording Secretary.....	Mr. Herbert P. Whitlock,
“ Treasurer.....	Mr. Gilman S. Stanton.

The reëlected President upon resuming the chair introduced the question of the change of name of the Club, suggesting that title of the organization be changed to the New York Mineralogical Society. He also brought up the question as to the advisability of incorporation and of increasing the number of vice-presidents and honorary members. After a discussion of these suggestions, on a motion by Mr. Stanton action upon these matters were deferred to the May meeting, and a committee was appointed by the President to report at the May Meeting. This Committee consisted of Dr. Hovey, Capt. Miller, and Messrs. Stanton, Manchester and Wintringham. The Treasurer submitted a report for the year.

A small exhibit was arranged by the Department of Mineralogy of the American Museum to show the published work of the late Professors Moses of Columbia, and Pirsson of Yale. This, as well as an exhibit of the recent accessions of the Department, were inspected by the members present after the meeting adjourned at 9.00 P.M.

HERBERT P. WHITLOCK, *Recording Secretary*.

ABSTRACTS—MINERALOGY

CELESTITE AND STRONTIANITE. FRANK L. CULIN. Arizona Univ., Bur. Mines, Bull. 35, Oct., 1916.

A detailed description of celestite and strontianite, with chemical tests, uses, methods of extracting and purifying, and summary of the various occurrences in the United States. L. S. RAMSDELL, W.F.H.

COPPER. P. E. JOSEPH. Arizona Univ., Bur. Mines, Bull. 37, Oct., 1916.

Describes physical properties, tests and occurrences of native copper, chalcocite, bornite, chalcopyrite, enargite, tetrahedrite, cuprite, malachite, azurite and chrysocolla. Also brief account of their origin. Descriptions of various Arizona districts, including Bisbee, Globe, Morenci and several others. L.S.R., W.F.H.

THE TSCHERMAK METHOD OF INVESTIGATING THE FORMULAS OF THE ACIDS ENTERING INTO SILICATES. G. CÉSARO. *Riv. min. crist. Ital.*, 49, 44-46, 1917.

The Tschermak method [which consists in treating the silicate with acid and determining the composition of the silicic acid liberated after bringing it to certain standard conditions] is favored; and its indication as to the composition of olivine as $Mg_2O.SiO_3$ is accepted. [This method is based on the theory that colloids have definite compositions, which is not held by most present-day chemists. ABSTR.] E.T.W.

NEPHELINE FROM PARCO CHIGI, ARICCIA, MONTI ALBANI. F. STELLA STARRABBA. *Riv. min. crist. Ital.*, 48, 52-64, 1917.

Small colorless crystals of nephelite occur in cavities in a metamorphic rock, composed mainly of biotite. They show the forms: (0001), (1010), (1120), (2021), and (10 $\bar{1}$ 1). The specific gravity is 2.65; refractive indices: ω_D 1.5417, ϵ_D 1.5382; data for other wave lengths are also given. By plotting analyses in a triangular diagram it is shown that nephelite is a solid solution of $Na_2Al_2Si_2O_8$ and $Na_2Al_2Si_3O_{10}$, with some replacement of Na by Ca and K. E.T.W.

CANCRINITE, ITS FORMULA, ITS BIREFRINGENCE, AND ITS NONEXISTENCE AT MONTE SOMMA. G. CÉSARO. *Riv. min. crist. Ital.*, 48, 65-79, 1917.

A highly complex [and improbable. ABSTR.] formula is derived. Reports that this mineral occurs at Monte Somma are considered to be unfounded. E.T.W.

THE RECENT ARTICLE BY CÉSARO ON CANCRINITE AND ITS NONEXISTENCE ON MONTE SOMMA. F. ZAMBONINI. *Riv. min. crist. Ital.*, 49, 90-93, 1917.

It is pointed out that if cancrinite is defined as a group of minerals with a certain range of composition, it certainly exists on Monte Somma. E.T.W.

CONTRIBUTIONS TO THE STUDY OF THE NATURAL SULFO-SALTS, 2. THE IDENTITY OF SYCHNODYMITE WITH CAROL-LITE. 3. THE CHEMICAL COMPOSITION OF ARGENTOPYRITES.

F. ZAMBONINI. Univ. Torino. *Riv. min. crist. Ital.*, **47**, 40-60, 1916; abstr. reprinted by permission from *Chem. Abstr.*, **13** (17), 1991, 1919.

The analyses which have been made of these and related minerals are discussed at length, and the possible presence of inclusions is pointed out. It is concluded that there is a linneite group, containing the minerals: linneite, $(\text{Co}, \text{Fe})\text{Co}_2\text{S}_4$, polydymite or nickelo-linneite, $(\text{Ni}, \text{Fe})\text{Ni}_2\text{S}_4$, carrollite, CuCo_2S_4 , and daubreelite, FeCr_2S_4 . [The abstractor doubts the correctness of the inclusion of the last two, because "carrollite" has been found upon mineralographic examination by Murdoch to be a mixture; and daubreelite has a single cleavage direction and hence must belong in another crystal system than cubic.]

The unsatisfactory data available on sternbergite, argyropyrite, frieseite, argentopyrite, etc., are discussed, and it is pointed out that all the analyses can be interpreted as essentially AgFe_2S_3 with small amounts of excess FeS and S. By analogy with pyrrhotite, one form of which is crystallographically close to these minerals, it is suggested that these excess constituents are present in solid solution. [A highly probable explanation. ABSTRACTOR.]

E.T.W.

THE ARGENTOPYRITES. G. CÉSARO. *Riv. min. crist. Ital.*, **49**, 3-43, 1917.

Previous theories of the constitution of these minerals are reviewed, and a new mathematical theory is proposed, according to which the general formula is $\text{Ag}_a\text{Fe}_b\text{S}_s = \text{Ag}_a\text{Fe}_t(\text{S}_2)_s - (t + \frac{1}{2}a)\text{S}_a'' + 2t - s$. [This represents an extreme development of the older view that minerals necessarily have definite formulas. The modern view applied to these minerals by Zambonini (see abstract above). that many cases of apparent complexity in composition are due to analyses having been made on impure material, but that excess components when not admixed are present in solid solution, seems preferable. ABSTR.]

E.T.W.

NEW OBSERVATIONS ON MOLYBDENITE AND OTHER MINERALS FROM ZOVON, EUGANEL. E. BILLOWS. *Riv. min. crist. Ital.*, **49**, 49-89, 1917; abstract reprinted by permission from *C.A.* **13** (18), 2168, 1919.

An elaborate statistical study of the occurrence and associations of the minerals in 450 specimens of "geodes" (vugs) in trachyte. The inferred paragenesis is: (1) quartz and pseudotridymite; (2) calcite and siderite; (3) pyrite and molybdenite; (4) molybdite, limonite, a mineral related to celadonite, and siderite pseudomorphous after pyrite; and (5) magnetite, biotite, ilmenite variety iserine, and pyrolusite.

E.T.W.

ARTIFICIAL PERICLASE, AND THE PROBABLE GENESIS OF THE PERICLASE OF MONTE SOMMA. G. CÉSARO. *Riv. min. crist. Ital.*, **48**, 80-81, 1917.

It is suggested that volcanic gases containing HCl acted on the Mg-bearing rocks of Monte Somma, forming MgCl_2 , which was subsequently decomposed, yielding crystalline MgO .

E.T.W.

CONTRIBUTION TO THE STUDY OF THE MINERALS OF VESUVIUS AND MONTE SOMMA. G. CÉSARO. *Riv. min. crist. Ital.* **48**, 3-52, 1917.

The humite group: Specimens containing members of this group were studied in the laboratory of mineralogy of the University of Cambridge. (One circle measurement used.) A rapid method for finding which member of the group is represented by a given crystal is: Find the zone $ph'(001)$ (100), which is always well developed, and the faces of which are striated parallel to the zone axis; An angle in this zone of 71° indicates chondrodite, 79° clinohumite, and 76° humite. The base can usually be recognized by being more or less hexagonal, and elongated in the y direction. The refractive indices and optical orientations (tabulated) are also characteristic. Tables of angles for each species are given. The results of measurement of a number of crystals of each species are tabulated, in comparison with the theoretical angles, in some cases according to two different orientations. The associated minerals are described also, with measurements of one crystal of forsterite, and of negative davynite.

Sarcolite: This is associated with augite, pyrrhotite, wollastonite, apatite, a variety of nephelite, and humboldtilite; some measurements of the last are given. The sarcolite crystals are colorless to pale yellow, and 2-4 mm. in diameter. Some have the usual forms as figured in Dana's System; others have peculiar angular relations. These are discussed mathematically, and a provisional interpretation is reached. Some apparently new forms are present, $b^2(102)$ and $b^7(017)$, and on another crystal $a^{17}(1.1.17)$.

Mineral of the nephelite group: This is unusual in possessing both basal and prismatic cleavage, and a double refraction between that of davynite and kaliophillite, negative, 0.035. *Pleonaste:* This is of octahedral habit, with the rare form (771).
E.T.W.

VIRIDINE AND ITS RELATION TO ANDALUSITE. E. A. WÜLFING. *Sitzb. Heidelberg Akad. Wiss., abh.* **12**, 1917; *Neues Jahrb. Min. Geol.*, **1918**, I, Ref. 259-261; thru *J. Chem. Soc.*

Certain green, red and greenish yellow andalusites have been called viridine or manganandalusite, and contain up to 10 percent. Fe_2O_3 and Mn_2O_3 , so that their formula is $(Al,Mn,Fe)_2SiO_5$. These are found to be optically + with $\gamma = c$, whereas andalusite proper is — with $\alpha = c$. Viridine is therefore believed to be a distinct species, representing a fourth polymorphous form of Al_2SiO_5 .
E.T.W.

THE RÔLE OF BORON IN SILICATES. G. CÉSARO. *Riv. min. crist. Ital.*, **50**, 3-31, 1918.

The boron in silicates is believed to function as an acid, the group B_2O replacing Si in many cases. Highly complex formulas are derived for various minerals on this basis.
E.T.W.

MINERAL FORMATION IN A BASALT. G. PANEBIANCO. *Riv. min. crist. Ital.*, **50**, 50-73, 1918.

Includes brief descriptions of calcite, quartz, and pyrite crystals, with notes on their formation.
E.T.W.

THE DEGREE OF APPROXIMATION OF THE CALCULATIONS IN CHEMICAL ANALYSES. C. PANEBIANCO. *Riv. min. crist. Ital.*, **50**, 32-49, 1918.

A mathematical discussion of the accuracy attainable in mineral analyses.
E.T.W.